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10/699,434	10/31/2003	John Michael O'Brien	108650-135084	2893
25943	7590	11/07/2005	EXAMINER	
SCHWABE, WILLIAMSON & WYATT, P.C. PACWEST CENTER, SUITE 1900 1211 SW FIFTH AVENUE PORTLAND, OR 97204			MAKI, STEVEN D	
			ART UNIT	PAPER NUMBER
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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
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10/699434

EXAMINER

ART UNIT	PAPER
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110105

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Commissioner for Patents

See (1) Non-responsive amendment (attached);
(2) translation for WO 90/15725 (attached);
(3) machine translation for DE 3721500 (attached).

Non-responsive amendment

Newly submitted claims 6 and 7 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-5, drawn to tire structure having first air passage, second air passage and secondary chamber at channel in tread (claim 1), first air passage, second air passage and tread strip having studs in channel (claim 4), or first stem portion, second stem portion and secondary chamber under expandable-retractable tread portion (claim 5), classified in class 152, subclass 210.
- II. Claims 6 and 7, drawn to tire structure having an air passage in one of the sidewall portions adjacent to and outward of the bead and tire rim and control that is exterior of the tire that actuates valve member for selectively allowing and preventing air from passing through the air passage, classified in class 152, subclass 415.

The inventions are distinct, each from the other because:

Inventions I and II are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the combination does not require

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an air passage in one of the sidewall portions adjacent to and outward of the bead and tire rim and control that is exterior of the tire that actuates valve member for selectively allowing and preventing air from passing through the air passage. The subcombination has separate utility such as a studless pneumatic tire having a non-expandable tread and a primary chamber, but not having a secondary chamber. In other words, the subcombination has separate utility such as a tire having only a primary chamber.

Furthermore these is evidence that the particular characteristics of the subcombination are not essential to the combination. Characteristics of Asp (e.g. a secondary chamber at the channel and an air line bonded to the interior wall of the casing and extending from said first air passage to the second passage as in claim 1) can be used to show that Bsp (an air passage in one of the sidewall portions adjacent to and outward of the bead and tire rim and control that is exterior of the tire that actuates valve member for selectively allowing and preventing air from passing through the air passage) does not constitute the sole distinguishing novelty in the combination.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for

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prosecution on the merits. Accordingly, claims 6 and 7 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

The amendment filed on 6-21-05 canceling all claims drawn to the elected invention and presenting only claims drawn to a non-elected invention is non-responsive (MPEP § 821.03). The remaining claims are not readable on the elected invention (i.e. the invention elected by original presentation) because: claims 6 and 7 are directed to a subcombination instead of the combination and fail to require first air passage, second air passage and secondary chamber at channel in tread (claim 1), first air passage, second air passage and tread strip having studs in channel (claim 4), or first stem portion, second stem portion and secondary chamber under expandable-retractable tread portion (claim 5).

Since the above-mentioned amendment appears to be a *bona fide* attempt to reply, applicant is given a TIME PERIOD of ONE (1) MONTH or THIRTY (30) DAYS, whichever is longer, from the mailing date of this notice within which to supply the omission or correction in order to avoid abandonment. EXTENSIONS OF THIS TIME PERIOD UNDER 37 CFR 1.136(a) ARE AVAILABLE.

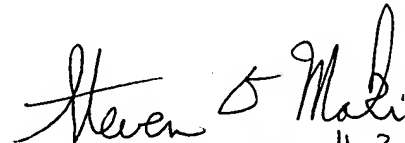
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven D. Maki whose telephone number is (571) 272-1221. The examiner can normally be reached on Mon. - Fri. 8:30 AM - 5:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas Dunn can be reached on (571) 272-1171. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Steven D. Maki
November 3, 2005


STEVEN D. MAKI 11-3-05
PRIMARY EXAMINER

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International Publication No. WO 90/15725 A1

METHOD FOR VARYING THE TREAD CONDITION OF MOTOR VEHICLE TIRES

Willi Liebig [DE/DE]

UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. AUGUST 2005
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METHOD FOR VARYING THE TREAD BAND PATTERN OF MOTOR VEHICLE TIRES

[Verfahren zur Variierbarkeit der Laufflächenbeschaffenheit von Kraft-Fahrzeugrädern]

Inventor and Applicant:

Willi Liebig [DE/DE]

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Mention of DE

Until further notice, any mention of "DE" in an International Application with an International Filing Date applies to the territory of the German Federal Republic with the exception of the territory of the former German Democratic Republic

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The invention pertains to methods and devices for varying the tread condition of motor vehicle wheels with pneumatic tires, whose friction properties in all driving states can be modified by an adaptation of the properties of the tread condition to the particular road conditions.

Methods and devices of this kind have already become known through several publications or patent applications.

For example, patent CH 542 732 discloses a design using multiple-chamber pneumatic tires and partial spike population, in which there is at least one inflatable, ring-shaped air chamber in the vicinity of the tread, whereby after inflation of this chamber or by relieving the pressure, the spikes can be brought into or taken out of use.

Specifically, the following deficiencies are associated with the design of the aforementioned patent CH 542 732:

- the control of the friction-reinforcing elements consists of an alternation of the nature of the tread condition from the state of "spikes not engaged" to the state of "spikes engaged," whereby this alternation is produced by a change in the tire pressure in the tire partial chambers.

This change in spike position can only be put into effect when the vehicle is stopped.

- The corresponding change in tire air pressure can only be implemented externally, e.g., by fueling station air pumps.

A fast response to sudden outbreaks of bad weather or to suddenly occurring icing on the road surface is not possible.

- Due to the potentially very different wear on the two, alternately stressed zones of the tire tread, depending on the road conditions—e.g., during the winter season—the spike zones or the spike-free zones of the tread may wear more, so that there will result pronounced fluctuations in the extended height of the spikes.

As a result,

- different tire rolling properties may occur, with accordingly increasing adverse effects on the suspension, and

- highly different force application conditions with sometimes very large material stresses may occur at the connection points of the pressure-controlled tread covering materials.

- The application of force necessary to control the spike engagement for the retraction and extension movements in the different tire tread zones is largely dependent on the particular degree of wear on the different tread zones. Therefore, an optimizing of the spike engagement on icy roads, with the objective of obtaining essentially uniform friction lock conditions on the tire contact areas, can only be achieved through a corresponding adaptation of the air pressure in the

* [The numbers in the right margin indicate the pagination of the original foreign text.]

tire partial chambers controlling the spike extension: The design according to CH 542 732 provides no indication of any adequate solution to this problem of control engineering.

Patent application DE-OS 21 31 918 uses a basic principle that is mostly similar to the design just described.

The design in DE-OS 21 31 918 is defined as follows:

"Motor vehicle wheel with grasping elements, characterized in that the grasping elements are located on a band positioned in the driving direction around the vehicle tire and that between the band and tire, features are provided that press the band outward."

The important disadvantages of this application, like those in the design of CH 542 732, arise from the mechanism of spike actuation. Accordingly, the following discussion also applies to DE-OS 21 31 918:

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- The control of the friction-increasing elements takes place due to a change of the grasping elements from the "spikes not engaged" position into the "spikes engaged" position whereby the grasping elements are pressed from a retracted state—without contact and thus low wear position—outward into a highly stressed and thus wear-intensive position. As a result of potentially very different wear on the alternately stressed portions of the tread substance, depending on the weather and road conditions during a winter season, the lateral, spike-free regions or the middle tire zones, armored with spikes and used only for driving on ice, will be subjected to greater wear, so that as a result of the differing wear, pronounced fluctuations in the extended height of the spikes may occur. As a result, highly different tire rolling conditions may occur with accordingly greater adverse impacts on the suspension and riding comfort together with a fluctuating dependability of the spikes when engaged.

- In the case of motor vehicle tires according to DE-OS 21 31 918, to move the grasping elements or the spikes from the "spikes not engaged" position into the "spikes engaged" position, relatively large extension motions with accordingly strong forces are needed, which will lead to correspondingly large stresses on the spike supports or on their connections to the tire tread.

- Due to the attachment of the spike-supporting bands to elastic bands, the result is a pronounced lability of the tire covering when corresponding tires are used as spike tires. This leads to a pronounced and adverse effect on the lateral control capability or on the tire tracking, especially when traveling on curves.

The design of antislip devices for motor vehicles disclosed with DE patent specification 21 06 225 and with the patent disclosures DE 35 23 506 A1 and DE 35 05 216 A1 have essentially the same technical engineering concept.

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The analogous tire antislip devices presented therein use cylindrical grasping elements, actuated by compressed air, in the tire treads. Characteristic of this design is the use of additional compressed air systems that are independent of the compressed air filled into the tire.

With the latter systems, in particular, the following problems are encountered: Large construction and manufacturing expense caused by the large expense of integration of the relatively complicated grasper actuating systems in the tires, significant hazards to functional dependability of the grasper actuating systems due to corrosion, road dirt and water, and also due to the associated icing tendency in the spike guides. Primarily the latter problem—in conjunction with the greater expense for sealing features to prevent losses of compressed air or to prevent the penetration of water with its associated icing problem—is largely responsible for the failure of these and similar systems to make any large-scale inroads in the market.

United States Patent No. 4,582,108 presents a system for wireless transmission of pulses that can trigger increases and control of tire pressure by means of wheel-internal control elements and control energies. The purpose of this patent is to change the tire pressure with the objective of changing the tire hardness and the tire inflated contact surface area.

In contrast to the design of the new application, however, no solution for the increase in tire bulging is indicated, with a view toward reducing the radii of the tread and no possibility is indicated for use of friction-increasing features or the inclusion of friction-increasing features.

The new invention is based on the problem of putting into effect friction-increasing measures rapidly on motor vehicle wheels with varying tread condition in all driving states by using a pressurized control so that a considerable improvement in the friction behavior on smooth road surfaces can be achieved, and specifically

- with the smallest possible impact on the tire riding comfort
- while essentially maintaining the tire stability and that of the wheel control behavior,
- in all driving states,
- with the smallest possible time requirement,
- with relatively little energy consumption, and
- with the greatest possible operating dependability.

This problem is solved by the characterizing properties of the application.

Several of the characterizing properties of the first claim inherently belong to the state of the art. Among these known properties is the use of grasping elements or of spikes, whose use as fixed or vulcanized constituents of the tire covering was prohibited by law—due to their tendency for damaging the road surface.

Additional possible solutions with moving spikes also belong to the state of the art, including those that use cylindrical openings, usually with passages, for guiding the spikes

through the tire covering to change from a non-contact into a contact position with the road surface. Several attempted solutions belong to the state of the art, in which spikes are placed on or in the tire tread part and are switched by application of pressure from "non-contact" into "road contact" positions.

The potential solutions based on these principles all suffer from the described problems as indicated in the analysis of DE-OS 21 31 918.

The new invention moves from the integrated use of several known properties to a new solution having the above-discussed advantages. /6

Characteristic of these new solutions are the following factors:

- Due to increased pressure within the tire partial chambers 1.3 or within multi-strand, hose-like control lines 20/21, parts of the tire covering 1.2 can bulge out by an amount ΔR according to the principle of flexure of flexure-stressed plates, so that by means of the elastic reduction of the radii of the tread -together with the partial increase in tire hardness—the parts 1.2 of the tire tread are exposed, with the result that here, a concentration of the wheel force onto a smaller wheel contact area will result, with a corresponding increase in friction resulting in an increased tendency for road surface penetration.

- This described principle of pressure controlled friction increase can be enhanced additionally by populating the exposed portions of the tread part 1.2 with friction-increasing features, including the use of grasping elements 15 in conjunction with their extension $\Delta R'$.

- The friction-increasing features—e.g., spikes or grasping elements 15 or special tire profiles—are integrated flush with the surrounding material of the tire tread for normal driving conditions. In all road conditions, i.e., when driving on dry and on icy roads, they have contact with the road surface.

- The principle described above of pressure-controlled friction increase can be enhanced by a pronounced elastic deformability of the tire casing, e.g., by minimizing or by entirely omitting one belt armoring.

- Due to the above principle of flush placement of friction-increasing features, the wear on these features can be adapted essentially to the wear on the other material of the tread, and specifically independently of the weather-related icing states of the roads, which are known to vary from year to year.

From this it follows that in the use of corresponding tires as spike tires, the spike extensions can be held mostly constant, regardless of whether the tires are in a new condition or have been subjected to wear of the rubber profile. From these findings it then follows that with regard to the invented design, the influence of the tires' wear status on the tire roll conditions and also on the flux of force conditions within the tire covering can be kept relatively small. /7

- Winter tires using the basic principle described above are suitable primarily for regions that have relatively short-term icing on road surfaces. For regions with long-lasting periods of frost—this applies, e.g., to northern countries or to the Alps—it may be necessary to modify this basic conception by using the properties of the dependent or additional claims, e.g., through the use of corresponding grasping elements or materials, or through the specific use of control engineering. This would mean in particular, the possibility according to this invention of changing the tire control pressure as a function of the wear state of the various zones of the tread, e.g., to compensate a relatively greater wear on the spike-populated tire zone 1.2 by an increase in pressure in the tire partial chambers 1.3 or in the hose-like control lines 20/21—with a corresponding increase in the spike extension.

With the design described above, according to the invention a rapid access to antislip measures will be possible with the vehicle stopped or moving.

Useful embodiments of the invention are indicated in the alternative independent claims or dependent claims.

Claims 1-3 illustrate various design embodiments of the invention. The consistency of these variants is retained in that in all cases, the friction-increasing features come into play through the enlargement of the bulging of portions of the tire casing part, whereby according to the design of Claims 1 and 2, the activation of the friction-increasing features takes place by means of a large-area application of force, and specifically by means of the application of pressure to tire partial chambers 1.3, whereas according to Claim 3, the corresponding control motion—e.g., of the spike support 19 and of the spikes 15—can take place by means of the application of pressure from multiple-strand, hose-like compressed agent control lines 20 according to Figures 3-5.

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Due to the pressure control of the properties of the tread condition by means of several hose-like pressure control lines 20 and 21 according to Claim 3, the following particular advantages are obtained:

- small thickness dimensions of the pressurized parts to handle the pressure forces, and specifically even at high pressures. The result is a light tire construction with relatively low gyrating mass,
- attainment of an excellent operating reliability through the potential to subdivide or cordon off the pressurized agent control lines 20 and 21, for example, into several independently functional units.
- Due to the potential to use simple shapes and components, a relatively low manufacturing cost can be achieved.

- The new design offers a simple means for engineering control and regulation of the desired spike position, since the spike carrier 19 as positioning element in conjunction with the compressed agent control lines 20 and 21 —e.g., by means of wheel-internal control valves 9 -- can produce extensions and retractions of the spikes.

- The stability of the tires is improved by the good integration of the grasping elements and of their control elements, and specifically inasmuch as web-like connections 22 can be provided between the individual hose elements or channels, so that it is possible to improve the force of flux between spike support 19 and ply 23 significantly. The influence of centrifugal force on the stress and deformation conditions in the region of the tread can thus be essentially eliminated or mastered.

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The conical shape of the grasping elements 15 according to the invention represents an important element for implementation of the spike restoring motion for switching the tire from "driving on ice" to "normal driving." The accuracy and speed of the spike positioning according to Claim 4 can be improved by application of pressure from elastic pressurized agent control lines 21 located above the spike support 19.

Claim 5 presents an example for the possibilities for applying force from the spike supports 19 to the spikes 15. In this regard, it should be stressed that the spike support 19 has to perform the tasks of guiding the spikes and of ensuring the spike pressure control by means of bundling and transfer of pressure forces from the multiple-strand compressed agent control lines. Accordingly, the spike support 19 will be manufactured in an appropriately flexible and supportive manner through the choice of suitable materials—e.g., through the use of armor-reinforced plastics or synthetic fabrics—or by special shaping, e.g., through special recesses 24 as per Figure 6.

The minimizing of access time according to this invention is attained with the properties specified in Claims 6-9, whereby the ignition of gas cartridges 8 using the airbag system, or the evaporation of substances like fluorochlorohydrocarbons, for example, or the inlet of compressed air from wheel-internal compressed air tanks 10 can ensure the necessary increase in tire pressure in the specific tire partial chambers 1.3 or in the control lines 20.

For this purpose according to Claim 6, pulses or signals triggered by the driver can be transferred mechanically or by one of the known methods for wireless signal transmission to the control and regulating elements in the wheels of a motor vehicle, so that here, the ignition of gas cartridges 8 or the triggering of pressure-generating chemical or physical reactions will effect a change in the pressure in the tire partial chambers 1.3 or in the compressed agent control lines 20, with a corresponding activation of the spike support 19.

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By means of an analog signal processor according to Claim 7, the passage of compressed gases from wheel-internal gas pressure equilizing chambers 10 into the tire partial chambers 1.3 or into the compressed agent control lines 20 (with a corresponding activation of the spike support 19) can be effected by the actuation of control valves 9. Claims 8 and 9 indicate the possibilities for additional improvements to the spike pressure control, and specifically through

- the automation of the control process by means of sensor actuation, according to Claim 8, and
- due to linkage of the tire pressure control with wheel force or brake antilock features, e.g., with so-called antilock systems according to Claim 9.

With regard to the situation above, it should be added that the pressure controls necessary for changing the tire—running properties can be controlled on a metered basis by using several gas cartridges 8, or differently metered ones, according to Claim 6, by metering the pressure with control valves 9 or by means of control units 6, which create the possibility of implementing the adaptation to the different road conditions by means of increases and decreases of the tire pressure.

The energy needed for implementing the control and regulating processes can also be supplied according to Claim 10 by a conversion of the wheel energy of motion into electrical energy, for example, by using coils or windings 12 in the wheels and magnets 13 on the vehicle frame, whereby their use can be regulated directly either by means of appropriate electric lines 14 or by energy storage in storage batteries or batteries 7.

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Claim 11 indicates how the engineering fields of hydraulics and pneumatics can be used to control the tire pressure according to this invention. In this case, the use of hydraulics offers the specific advantage of the lesser compressibility of this pressurized medium. Furthermore, to control the friction-increasing activities, hydraulic and pneumatic elements and media can be used in combination, and their linkage into jointly acting control units can be effected by means of pressure reservoirs, pressurized agent converters 25, or by means of pressure translators.

According to Claim 12, the different zones of the tire tread can be manufactured with tire materials having different characteristics. In this case, specific materials can be selected such that during driving on a normal road surface with frost-free weather conditions, normal zones of the tread 1.1 using tire materials with the standard friction values will determine the driving properties. But in the case of an icy road surface—in conjunction with a tire pressure control according to Claims 1-9—special tire tread 1.2 can come increasingly into play which are made of materials with better friction values for icy layers or with greater hardness to penetrate into the icy layers of the road surface, or with larger water-shunting channels to counteract aquaplaning.

According to the properties of Claims 13 and 14, the material of the friction-increasing features, e.g., the spikes 15, is adapted to the wear resistance of the surrounding tire material, so that when driving on normal road surfaces, the friction-increasing features fit essentially flush with the normal tire treads and are worn off at the same rate, whereas an extension of the friction-increasing features from the surrounding tire material will only occur after increases in pressure, for example, in the tire partial chambers 1.3. With the potential for very rapid intervention in critical road conditions according to this invention and in conjunction with a limitation of the time of usage of the particularly exposed zones of the treads, according to Claims 13 and 14, the wear on the friction-increasing features can be minimized and the wear on all parts of the tread can be essentially equalized. From this state of affairs, there will be rather little adverse impact on the tire riding comfort during the operation of motor vehicle tires equipped according to the invention.

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According to Claim 16, to prevent the inlet of water, the spikes are installed with shrinkage stresses into the tire tread. According to Claim 15, the spikes 15 have a conical design with an outward taper and are inserted tightly or with shrinkage stresses into the tire covering, so that an optimizing of the seal of the spike controls can be achieved with the spikes extended or retracted. With this type of spike configuration, it is also possible that the force conditions at the inclined spike surfaces will support the return motion into the flush-fitted starting position of the spikes which is effected by the wheel contact forces after completion of the pressure application to the spikes. An additional means for sealing the spikes is indicated in Claim 17, such that the selection of the properties of the spike material and of the surrounding portions of the tire will create a material combination with water-repellent or capillary depressive tendencies.

According to the description in Claim 18, the intensity of the friction-increasing features can be increased considerably. For this purpose, the grasping elements 15 in the interior of the tire covering are surrounded by a more elastic or more porous material, in comparison to the tire covering layer, by the use of inlays 16, for example, and the particular position of the friction-increasing features with respect to their extended height is governed by the interaction between the outward acting force of the tire internal pressure in the tire partial chamber 1.3, and the elastic or compressible, or elastically prestressed inlay 16 within the tire covering.

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According to Claim 19, the bulging tendency ΔR of the treads caused by the pressure change can be affected by special armoring inlays 17, and specifically with the goal of optimizing the tire contact surface area and the roll behavior, so that the selection of appropriate materials, the coordination of their dimensions and a prestressing of the armoring layers 17 that support the desired curvature tendency will be of primary importance.

An improvement in the ease of assembly and repair is specified in Claim 20 by using the configuration of the spike-armored special tread zone 1.2 as a bandage 18.

An additional application of the invented tire concept as an all-weather tire is indicated in Figure 7, e.g., via a three-chamber tire according to Claim 21: Here, special tread zones 1.2 are equipped with different features to adapt to the different road conditions; due to the pressure control of the tire partial chambers 1.3, these features will copy the bulging ΔR and thus contribute to the change in tire friction properties.

Also, according to Claim 22, the objective of an all-weather capable tire concept using the principle of the multiple chamber tire is defined, and specifically such that according to Figure 8, the primary tire chamber is divided by a strong membrane 26 connecting the sidewalls of the tire, so that the flexure of the membrane caused by the pressure effects will trigger a reduction in the spacing of the two sidewalls and thus a reinforcement of the bulging tendency of the tire tread band pattern ΔR .

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The invention will be explained in greater detail below with regard to Figures 1-9 and with regard to the definition of several new properties. It should be mentioned that the consistency of the examples according to Figures 1 and 3/4 is assured since in both cases, the friction-increasing features come into play through an increase in the bulging of the portions of the tire tread covering, whereby according to Figure 1, the activation of the friction-increasing features takes place by means of a large-area application of force, and specifically due to application of compressed agent to the tire partial chamber 1.3, whereas according to Figures 3 and 4, the corresponding control motion (e.g., of the spike support 19 and the spikes 15) is effected through an application of pressure from multiple-strand, hose-like compressed agent control lines 20.

Figure 1 shows the principle of the new method according to Claims 1 and 2, whereby this figure in particular indicates the influence of the tire pressure control on the tire bulging ΔR and $\Delta R'$ by means of a comparison of tire states 1 and 2.

Figure 2 shows a detailed illustration of the features or configuration of the special tire tread zone 1.2.

Figure 3 presents a series of characteristic parts for an implementation according to Claims 3 and 4, whereby the principles of these claims are illustrated in particular through the detailed illustration A in Figure 5—with a comparison of tire states 1 and 2.

Figure 4 shows a partial cross section through a motor vehicle wheel according to this invention, with the potential for a hydropneumatic pressure control, and specifically together with an external compressed agent supply via the connection 27 at the rim edge.

Figure 6 shows the principle of a spike support whose deformability is increased by means of recesses 24. Figure 7 illustrates the design of an all-weather tire in the form of a combination of several elements of the invention.

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Figure 8 illustrates the principle of an all-weather tire according to Claim 22, whereby the influence of the pressure control according to this invention is explained by means of a comparison of two extreme tire states.

The operation of this tire is such that underneath the tread, there is a membrane (26) connecting the sidewalls of the tire. Due to flexure of the membrane caused by an application of pressure, a reduction in the spacing between the two sidewalls will occur, and thus a reinforcement of the bulging tendency of the tire tread will result.

Figure 9 shows a simple form of the invented control of the tire's properties, whose principle consists in the exposure of the friction-increasing features by means of a pressure increase within the primary tire chamber.

The invention will be explained in greater detail below by using an example based on Figures 1 and 2.

With the assumption of a particularly critical, hazardous situation, caused by the sudden arrival of a moving vehicle onto an icy road surface, by means of the shortest possible access time, an immediate adaptation of the chassis to the new road situation is to be achieved.

To handle this situation, according to the invention (see Figure 1) the following apparatus will come into play:

- Rims 2 and tire 1 with separately actuated, pressurized tire partial chambers 1.3,
- the features of the special tire tread zones 1.2 with grasping elements 15 according to Claims 13-15, with preformed armoring inlays 17 according to Claim 19, and special elastic inlays 16 according to Claim 18,
- gas cartridges 8 with their ignition mechanism in the wheels 1 / 2.

Features to initiate and transfer the ignition pulse for the gas cartridges 8; specifically these are:

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- sensors for temperature and moisture underneath the vehicle near the tire and road surface,
- converter and amplifiers to convert the measured values from the sensors, e.g., into electromagnetic waves,
- transmitters, depending on the choice of information processing or on the signal generator or pulse generator 3
- pulse receivers or receivers 4 for input of the signals or pulses from the pulse generator 3, and also

- pulse guides 5, regulators or control valves 9, electric power capacitors 7, gas pressure lines 11 and control and regulating systems 6 for processing the pulses or signals, e.g., for the gas cartridges 8 or for control of the tire pressure via the gas pressure equalizing chamber 10.

If a motor vehicle equipped according to the invention is traveling when the sensors record critical, wet road surface states at temperatures in the range of the freezing point, then after an acoustical-optical warning to the driver for example, an automatic system can be set into operation which will trigger ignition pulses after the critical limit values have been reached, which will cause the gas cartridges 8 to ignite due to the signals coming from the sensors and moving via the pulse converter, the wireless information bus 3 and 4, and also via the information processor in the control and regulating system 6. After this ignition, the tire pressure will be increased in the tire partial chambers 1.3 so that the tire tread band patterns will bulge out or two extended or supporting tire elements will come into play which cause a reduction in the tire contact surface area and an increase in the surface pressure and thus a penetration and grasping in the ice on the roadway.

With this design, essentially tire rolling and friction conditions can be achieved like those occurring for example, when driving with spiked tires, but with the important advantage of the new design that now it is possible to adapt quickly to critical situations arising from sudden icing of the road surface. In particular, with the new design, the tendency to damage the road surface is kept relatively low, since the employment of the grasping elements only comes into play when traveling over critical sections of the road.

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Furthermore, the new design offers the potential to reduce the hardness of the grasping elements—potentially while eliminating the hard metal—so that thereby the wear on the grasping elements can be adapted to that of the other tread.

Since the hardness of the grasping elements—in contrast to that of spikes in the normally spiked tires—does not have to be designed for the long-term wear due to contact with the usual road surface, a lesser hardness will be sufficient here which can be tailored on the one hand, to the penetration into ice, and on the other hand, for a reduced exposure time while driving on ice-covered roads.

The adaptation of the tire special tread zone 1.2 to the hazard, e.g., due to melting snow or water—with the corresponding danger of aquaplaning—can also be achieved by large profiled channels between the supporting elements of the tread, whereby preferably the invented principle of bulging of the tread band patterns will come into play, e.g., with elimination of grasping elements.

Furthermore, the new concept offers the potential to improve the driving safety of motor vehicles by a controlled linkage with brake antislip devices or with antilock systems.

With regard to the importance of the new design, it should be stressed that primarily the black ice weather situations will lead to an increased frequency of accidents, and specifically, often in conjunction with large-scale, chain-reaction collisions.

In particular, the fitting of rescue vehicles according to the design described above can reduce significantly the time elapsed from the moment of the emergency until arrival of emergency management personnel, since assistance or rescue vehicles with the above-referenced equipment will have an important improvement to their maneuverability in critical road conditions—with a corresponding reduction in travel times.

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Both the description and also the figures that illustrate the patent application have omitted numerous technical details in the interest of a concise presentation of the principle of the invention. This applies in particular to the presentation of valves, screw connections, seals, gaskets, electrical apparatus or partial joints on the rims, which could be disconnected to allow better access to the control devices and their connections.

The control and regulating system 6 plays a central role in the variation of tire bulging ΔR in conjunction with the resulting control of the properties of the tire tread condition. In addition to the mentioned control of the friction-increasing activities, it must also perform the following tasks:

- Control of the release of compressed air or of the gas-air mixture from the interior of the tire 1 or from the tire partial chambers 1.3, with the purpose of effecting a return of the tire bulging to the normal state for dry road surfaces;
- Control of the exchange of information with the interior of the motor vehicle so that the driver will have all relevant data on the condition of the wheels and apparatus—e.g., regarding the tire pressure situation, the energy reserves or the wear state of the parts.

Claims

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1. Method for varying the tread condition for motor vehicle wheels with pneumatic tires whose treads (1.1/1.2) are equipped with friction-increasing features—e.g., with spikes (15)—so that the friction behavior of the wheels on anomalous road surfaces can be changed by a change in the nature of the tire tread condition caused by a change in the tire pressure in the tire partial chambers (1.3), characterized in that the friction-increasing features of the tire tread

- are located essentially flush in the adjoining tread cover material (Figure 1, state 1), and
 - in normal road surfaces rest upon the road together with the other regions of the tire tread under the influence of the wheel force,
- whereas for critical road states—e.g., caused by ice or water—
- by means of increases in pressure in tire partial chambers (1.3),

- due to the use of energy carriers (7/8) located internally to the wheel and controlled by control and regulating systems (6 and 9) within the wheel,
- by means of an especially pronounced, elastically deformable tire cover—e.g., due to a nonbelted armoring or due to special inserts
- an elastic enlargement of the bulging (ΔR) of the tire tread will result, so that a concentrated wheel force can be exerted on the friction-increasing features.

2. Method for varying the tread condition for motor vehicle wheels with multiple chamber pneumatic tires whose treads (1.1/1.2) are equipped with friction-increasing features—e.g., with spikes (15)—so that the friction behavior of the wheels on anomalous road surfaces can be changed by a change in the tire traction behavior caused by a change in the tire pressure in the tire partial chambers (1.3), characterized in that the friction-increasing features of the tire tread (1.2/15)

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- are located essentially flush in the adjoining tread cover material (Figure 1, state 1), and
- in normal road surfaces rest upon the road together with the other regions of the tire tread (1.1/1.2) under the influence of the wheel force,
- whereas for critical road states—e.g., caused by ice or water—
- by means of increases in pressure in tire partial chambers (1.3)
- by means of a correspondingly increased application of force to the internal tread-covering sides of the friction-increasing feature
- against the elastic resistance of the elastic materials (16) surrounding the friction-increasing feature

- due to a push out of the friction-increasing feature from the tread (Figure 1, state 2) a concentration of wheel force onto the friction-increasing features can be effected.

3. Method for varying the tread for motor vehicle wheels with pneumatic tires from whose tread surface grasping elements can be extended and retracted when the vehicles are stopped or moving, by means of pressurized controls, characterized in that the grasping elements or spikes (15)

- under normal road surfaces fit essentially flush with the surrounding tire material of the tire tread,
- under normal road surfaces, rest upon the road surface, together with the other regions of the tire tread (1.1/1.2), under the influence of the wheel force
- in the interior of the tire cover there are belt-like spike supports (19) attached to relatively flexible [locations]
- and for critical road conditions, e.g., icy streets,

- due to the application of force to the spike supports (19), [the spikes] are extended from the tire tread, and specifically

- due to the application of pressure from multiple-strip, elastically deformable hose-like or channel-like pneumatic control lines (20) onto the spike supports.

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4. Motor vehicle wheels according to Claim 3, characterized in that the retraction tendency of the spikes can be triggered or amplified by means of the application of pressure from elastic pneumatic control lines (21) located above the spike support (19).

5. Motor vehicle wheels according to one of Claims 1-4, characterized in that in order to optimize their operation, the spike supports (19) can be designed through the selection of suitable materials—e.g., in the form of armor-reinforced synthetics or synthetic fabrics—or by special shaping activities—e.g., by specific recesses (24)—to have appropriate elasticity under the specific load.

6. Method for varying the tread condition of motor vehicle wheels with pneumatic tires according to one of Claims 1-5, characterized in that pulses or signals initiated by the driver are transferred mechanically or by means of one of the known methods for wireless signal transmission, to the wheels of motor vehicles, and here cause increases in pressure in the tires (1) or in the control strips (20/21), for instance, by means of the ignition of gas cartridges (8) or by means of the initiation of pressure-increasing chemical or physical reactions.

7. Method for varying the tread condition of motor vehicle wheels with pneumatic tires according to one of Claims 1-6, characterized in that pulses triggered by the driver are transferred mechanically or by means of one of the known methods for wireless signal transmission (3/4) to the wheels of motor vehicles, and here cause compressed gases located in gas pressure compensation chambers (1.3) located within the wheel to move into the tire partial chambers (1.3) or into the control strips (20/21) due to the actuation of control valves (9).

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8. Method for varying the tread condition of motor vehicle wheels with pneumatic tires according to one of Claims 1-7, characterized in that the pressure changes within the tire or within the control strips (20/ 21) respectively, needed to change the properties of the tire tread, are triggered by pulses from sensors—e.g., by temperature or water sensors—so that the adaptation of the tire's properties to the road condition will be effected automatically.

9. Method for varying the tread condition of motor vehicle wheels with pneumatic tires according to one of Claims 1-8, characterized in that the pulses for pressure control according to Claims 1-8 are triggered by wheel force or brake slip control devices—e.g., by antilock brake systems—or are used in conjunction with them for wheel force control.

10. Method for varying the tread condition of motor vehicle wheels with pneumatic tires according to one of Claims 1-9, characterized in that the energy needed for effecting the control

and regulation processes, or for the generation of pressure, is supplied by means of the conversion of the wheel's energy of motion into electric energy—e.g., by means of coils or windings (12) to the wheels and magnets (13) to the motor vehicle battery cells—and via corresponding electric lines (14) either directly or via storage in storage batteries (7) for control of tire pressure.

11. Method for varying the tread condition of motor vehicle wheels according to one of Claims 1-10, characterized in that to control the friction-increasing effects, hydraulic and pneumatic elements and media are employed individually or in combination, whereby their linkage into joint acting control units can be assured by means of a pressure reservoir, compressed media converter (25) or by means of a pressure converter.

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12. Motor vehicle wheels with pneumatic tires according to one of Claims 1-11, characterized in that different zones of the tire treads are equipped with tire materials of different properties, and specifically such that a portion of the tread (1.1) is made of tire materials with the usual friction values that define the driving characteristics, whereas the special tire treads (1.2) that are influenced by controlling the tire pressure are made from materials with better friction values for ice layers on the road surface, which can be attained, for example, by the admixture of metallic or organic particles, or of ceramic granulate or by the formation of porous structures.

13. Motor vehicle wheels with pneumatic tires according to one of Claims 1-12, characterized in that the special tire treads (1.2) that are variable by means of tire pressure controls, are equipped with grasping elements or spikes (15) that fit flush to the surrounding tread material for normal driving on ice-free road surfaces.

14. Motor vehicle wheels with pneumatic tires according to one of Claims 1-13, characterized in that the material of the friction-increasing features—e.g., made of grasping elements (15) or special support—is adapted to the wear resistance of the surrounding tire material.

15. Motor vehicle wheels with pneumatic tires according to one of Claims 1-14, characterized in that the grasping elements or spikes (15) are designed conically with an outward tapered tendency.

16. Motor vehicle wheels according to one of Claims 1-15, characterized in that the grasping elements or spikes are set into the tire tread with shrinkage stresses to prevent the inlet of water.

17. Motor vehicle wheels according to one of Claims 1-16, characterized in that the nature of the materials of the grasping elements or spikes is chosen so that when they are combined with the surrounding materials or with the introduced lubricants, a water-repellent or capillary-depressive tendency will result.

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18. Motor vehicle wheels with pneumatic tires according to one of Claims 1-17, characterized in that the grasping elements or spikes (15) are surrounded in the interior of the tire cover by elastic inlays (16) that consist of a less strong or more elastic or more porous material in comparison to the tire cover layer.

19. Motor vehicle wheels with pneumatic tires according to one of Claims 1-4, characterized in that the control of the bulging of the treads can be affected by small armoring—e.g., by the omission of a belt armoring—or by special armoring inlays (17), so that the choice of corresponding materials and a prestressing of armoring inlays (17) promoting the desired curvature tendency will be used primarily.

20. Motor vehicle wheels with pneumatic tires according to one of Claims 1-19, characterized in that the bulgable special zones of the tire treads (1.2) are designed as replaceable band layers (18).

21. Method for affecting the properties of the tread conditions of motor vehicle wheels according to one of Claims 1-20, characterized in that in the tire treads, parts of the tires are equipped with different features and special tire partial chambers to adapt to different road conditions, and due to the pressure control in partial tire chambers (1.3) or by means of control strips (20/21), these features are caused to bulge (ΔR) alternately or jointly or the friction-increasing features will be extended.

22. Motor vehicle wheels with pneumatic tires according to one of Claims 1 and 2, characterized in that under the tread there is a membrane (26) linking the sidewalls of the tire, so that the flexure of the membrane caused by the application of pressure will cause a reduction in the spacing of the two sidewalls and thus a reinforcement of the bulging tendency of the tire tread.

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Revised Claims

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[submitted to the International Patent Office on 29 November 1990 (29.11.90); original Claims 12-14 and 18 deleted; original Claims 1-11, 15-17, 19-22 replaced by revised Claims 1-11, 15, 17, 19-22; new Claims 23 and 24 added (7 pages)]

Claims

1. Method for varying the tread condition for motor vehicle wheels with pneumatic tires whose treads (1.1/1.2) are equipped with friction-increasing features—e.g., with spikes—so that the friction behavior of the wheels on anomalous road surfaces can be changed by a change in the nature of the tire tread caused by a change in the tire pressure in the tire partial chambers (1.3), characterized in that the friction-increasing features of the tire tread

- are concentrated in a special tread (1.2)--positioned or located essentially flush in the adjoining tread material (Figure 1, state 1) and

- in normal road surfaces, rest upon the road together with the other regions of the tire tread under the influence of the wheel force, whereby

- the friction properties or the ice-penetrating capacity of the friction-increasing features is influenced by the use of particularly hard tire materials, by the admixture of metallic particles or of ceramic granulate, by the formation of porous structures or by a special configuration of the profile with a pronounced drainage property, whereby

- the friction-increasing features are made of materials whose wear properties or whose wear resistance is adapted to the surrounding tire tread, whereby

- for critical road conditions—caused by ice, water or fouling of the road surface,

- by means of increased pressure in one of the tire partial chambers (1.3) allocated to the special tread,

- due to the use of energy carriers—in the form of stored compressed air (10)--located internally to the wheel and controlled by control and regulating systems (6 and 9) within the wheel,

- an elastic enlargement of the bulging (ΔR) of the tire tread in the sense of a diminution of the tread radii, and

- an increase in the hardness of the tread, with

- a concentration of wheel force onto the friction-increasing features will result.

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2. Method for varying the tread condition for motor vehicle wheels with multiple chamber pneumatic tires whose treads (1.1/1.2) are equipped with friction-increasing features (15) so that the friction behavior of the wheels on anomalous road surfaces can be changed by a change in the properties or shape of the tread condition caused by a change in the tire pressure in the tire partial chambers (1.3), characterized in that

- the friction-increasing features or spikes (15) are located together with their spike supports and elastic inlays (16) within the tire cover, whereby

- the spikes are guided by the surrounding tire rubber and are made of materials whose wear properties or whose wear resistance is adapted to the surrounding tire tread, so that

- under normal road conditions, they fit essentially flush with the surrounding tire material, and

- contact the road together with the surrounding portions of the tread parts,

- whereas for critical road states—e.g., caused by ice, water, or road surface fouling—in all driving conditions

- a wireless transmission of control signals that controls the spike position can occur to the wheel-internal control elements (6/9), whereby

- by means of control energy stored inside the wheel—in the form of stored compressed air (in 10)--

- by means of increases in pressure in tire partial chambers (1.3) located underneath the spike supports

- against the elastic resistance of the elastic inlays (16) surrounding the friction-increasing feature

- due to a push out of the spikes from the tread (Figure 1, state 2)

- a controlled extension movement ($\Delta R'$) of the spikes—limited by features (22)—will occur.

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3. Method for varying the nature of the tread condition of motor vehicles with pneumatic tires, on whose tread there are spikes (15) that can be extended and retracted by means of the tire-internal application of pressure from hose-like compressed medium lines engaged with belt-like spike supports (19), characterized in that

- the spikes together with their belt-like spike supports (19) and their elastic, hose-like control strips (20 and 21) are located inside the tire's corresponding tire cover, whereby

- the spikes are guided by the surrounding tire rubber and are made of materials whose wear properties or whose wear resistance is adapted to the surrounding tire tread, so that the spikes

- under normal tire conditions, fit essentially flush with the surrounding tread band pattern material, and

- under normal road conditions, they contact the road surface together with the surrounding parts of the tread,

whereas under critical road conditions—caused by ice or fouling of the road surface

- under all road conditions

- a wireless transmission of control signals that controls the spike position can occur to the wheel-internal control elements (6/9), whereby

- by means of control energy stored inside the wheel—in the form of stored compressed air (in 10)--

- by means of increases in pressure in the elastic hose-like or channel-like, multi-strip control lines (20) located underneath the spike support,

a controlled extension movement ($\Delta R'$) of the spikes—limited by features (22)—will occur.

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4. Motor vehicle wheels according to one or both of Claims 2 and 3, characterized in that the retraction tendency of the spikes can be triggered or amplified by means of the application of pressure from elastic pneumatic control lines (21) located above the spike support (19).

5. Motor vehicle wheels according to one or more of Claims 2-4, characterized in that in order to optimize their operation, the armoring inlays (17) or the spike supports (19), respectively, can be designed through the selection of suitable materials—in the form of elastic belting materials or armor-reinforcing materials—or by special shaping activities—in the form of specific recesses (24) or by means of flexible belt strips of the armoring—to have appropriate elasticity under the specific load.

6. Method for varying the tread condition of motor vehicle wheels with pneumatic tires according to one or more of Claims 1-3, characterized in that pulses or signals initiated by the driver are transferred by means of one of the known methods for wireless signal transmission, to the wheels of motor vehicles, and here cause increases in pressure in the tires (1/1.3) or in the control strips (20/21), by means of the initiation of pressure-increasing chemical or physical reactions in the form of the ignition of gas cartridges or in the form of evaporation of propellant gases.

7. Method for varying the tread condition of motor vehicle wheels with pneumatic tires according to one or more of Claims 1-3, characterized in that pulses triggered by the driver are transferred by means of one of the known methods for wireless signal transmission (3/4) to the wheels of motor vehicles, and here cause compressed gases located in gas pressure compensation chambers (10) located within the wheel to move into the tire partial chambers (1.3) or into the control strips (20/21) due to the actuation of control valves (9).

8. Method for varying the tread condition of motor vehicle wheels according to one or more of Claims 1-7, characterized in that the pressure changes within the tire or within the control strips (20/ 21) respectively, needed to change the properties of the tire tread, are triggered by pulses from sensors—that is, by sensors for ice, temperature or water.

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9. Method for varying the tread condition of motor vehicle wheels according to one or more of Claims 1-8, characterized in that the pulses for pressure control according to Claims 1-3 are triggered by wheel force control devices—in the form of antilock brake systems or drive slip devices—or are used in conjunction with them to control the friction-influencing features.

10. Method for varying the tread condition of motor vehicle wheels according to one or more of Claims 1-9, characterized in that the energy needed for effecting the control and regulation processes, or for the generation of pressure, is supplied by means of the conversion of the wheel's energy of motion into electrical energy by means of the dynamo principle using windings and magnets—placed together on the wheels and on the vehicle storage battery—and is

made available for control of the tire pressure via corresponding electric lines (14) either directly or via storage in storage batteries (7).

11. Method for varying the tread condition of motor vehicle wheels according to one or more of Claims 1-3, characterized in that to control the friction-increasing effects, hydraulic and pneumatic elements and media are employed individually or in combination, whereby their linkage into joint acting control units can be assured by means of a pressure reservoir, compressed media converter (25) or by means of pressure converter.

15. Motor vehicle wheels with pneumatic tires according to one or more of Claims 1-3, characterized in that the grasping elements or spikes (15) are designed conically with an outward tapered tendency.

16. Motor vehicle wheels according to one or more of Claims 1-3, characterized in that the grasping elements or spikes are set into the tire tread with shrinkage stresses to prevent the inlet of water.

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17. Motor vehicle wheels according to one or more of Claims 1-3, characterized in that the nature of the materials of the grasping elements or spikes is chosen so that when they are combined with the surrounding materials or with the introduced lubricants, a water-repellent or capillary-depressive tendency will result.

19. Motor vehicle wheels with pneumatic tires according to one or more of Claims 1-3, characterized in that the control of the bulging (ΔR) of the treads can be affected by special armoring inlays (17) in the sense of a reduction in the radii of the treads, so that the choice of corresponding elastic materials and a prestressing of armoring inlays promoting the desired curvature tendency will be an important factor.

20. Motor vehicle wheels with pneumatic tires according to one or more of Claims 1-3, characterized in that the bulgable special zones of the tire treads (1.2) are designed as replaceable band layers (18).

21. Method for affecting the properties of the tread condition of motor vehicle wheels according to one or more of Claims 1-3, characterized in that to adapt to different road conditions, the tire treads are divided into several tread zones with different features and special tire partial chambers, and due to the pressure control in partial tire chambers (1.3) or by means of control strips (20/21), these features are caused to bulge (ΔR) alternately or jointly or the friction-increasing features ($\Delta R'$) will be extended.

22. Motor vehicle wheels with pneumatic tires according to Claim 1, characterized in that under the tread, there is a membrane (26) linking the sidewalls of the tire, so that the flexure of the membrane caused by the application of pressure will cause a reduction in the spacing of the two sidewalls and thus a reinforcement of the bulging tendency of the tire tread.

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23. Features according to one or more of Claims 2-22, characterized in that in place of the spikes (15), any other shaped, friction-increasing means or grasping elements are used, and in place of the spike support (19), belt-like support elements are used to guide and control the friction-increasing means or the grasping elements.

24. Method for varying the properties of the tread condition of motor vehicles with pneumatic tires according to one or more of Claims 1-3, characterized in that the transmission of the control signals for actuation of the wheel-internal control devices (6/8/9) controlling the extension motion of the spikes is effected by mechanical pulse transmission from the vehicle chassis to the wheels in the form of a cam control (at 3 / 4).

CLARIFICATION SPECIFIED IN ARTICLE 19

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1. Justification for the changes

1.1) Regarding the deletions:

The old claims 12/13/14 and 18 were deleted. Properties of these claims were placed into Claims 1-3.

Therefore, with reference to the statements in the description and the figures, this will better illustrate the complexity of my design.

1.2) A new Claim 23 was added. Its property of "versatility of the various friction-increasing means" was or is made evident in several (old) claims and in the description.

The reason for adding this new Claim:

Reducing or avoiding redundant text, eliminating the need to list separately all technically common friction-increasing means in a large number of the claims.

Claim 24 refers back to the splitting of Claims 6 and 7. The reason for the splitting and revision is the property of "mechanical signal transmission."

The purpose of this change is to emphasize the possibility for affecting the nature of the tire tread condition by simple, mechanical means as well.

1.3) Regarding the changes to the old Claims.

The old Claims 1-11, 15-17 and 19-22 were replaced by the new Claims 1-11, 15-17 and 19-22.

The differences between the old and new versions are the result of the following factors:

- due to "changes in wording" or
- due to a more precise presentation of the statements,

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- for Claims 1-3, due to addition of properties that were already made evident in the description or in the figures,

and

- for Claims 6 and 7, due to the deletion of the property of "mechanical signal transmission." This property was moved into the new Claim 24.

2.) Effects on the Description

Due to the elimination of Claims 12/13/14 and 18, the agreement or coincidence between the "Description" and the "Patent Claims" was significantly altered:

- a) Several statements in the Description appear out of place. For example, the text in lines 400-434 and the lines from 455-467 had to be deleted or revised.

- b) Due to the placement of properties from the referenced Claims into Claims 1-3, the corresponding descriptive text—especially from lines 195 to 314—had to be reworked.

3.) Effects on the Figures

Figure 9 can be deleted because it is no longer relevant. This also applies to the text that explains this figure as indicated in lines 550-554.

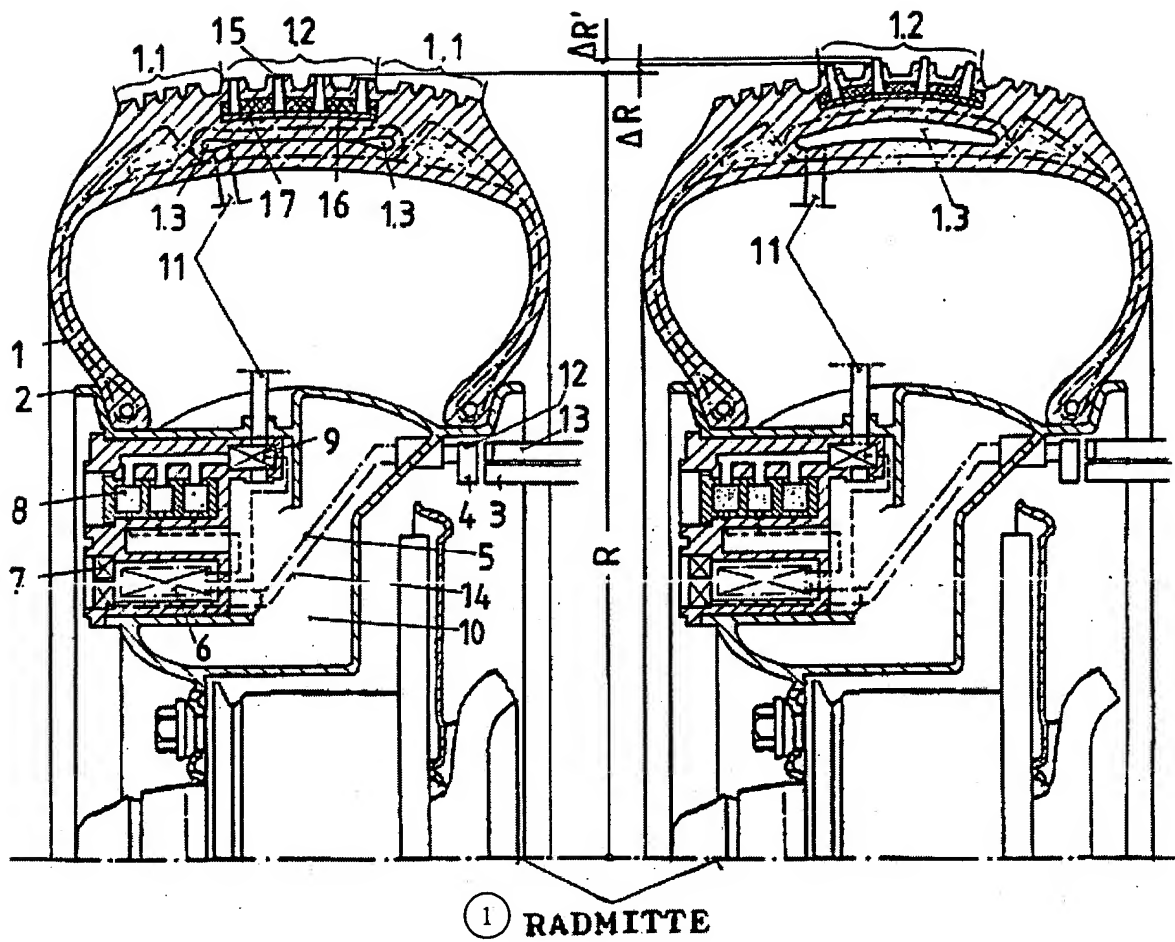


Figure 1. State 1: For normal road conditions. State 2: For icy road conditions

Key: 1 Middle of wheel

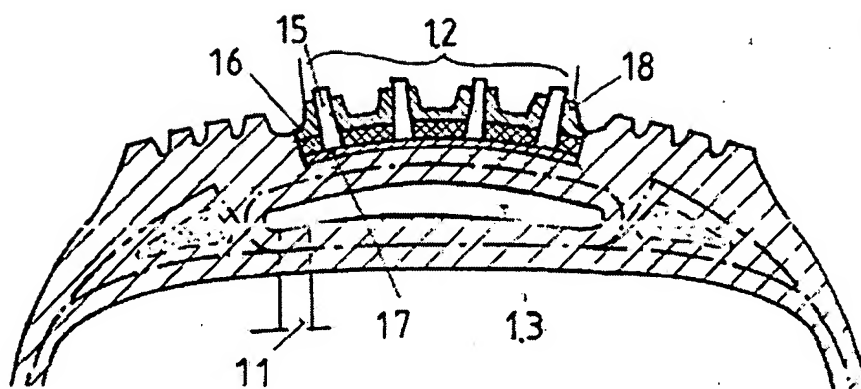


Figure 2

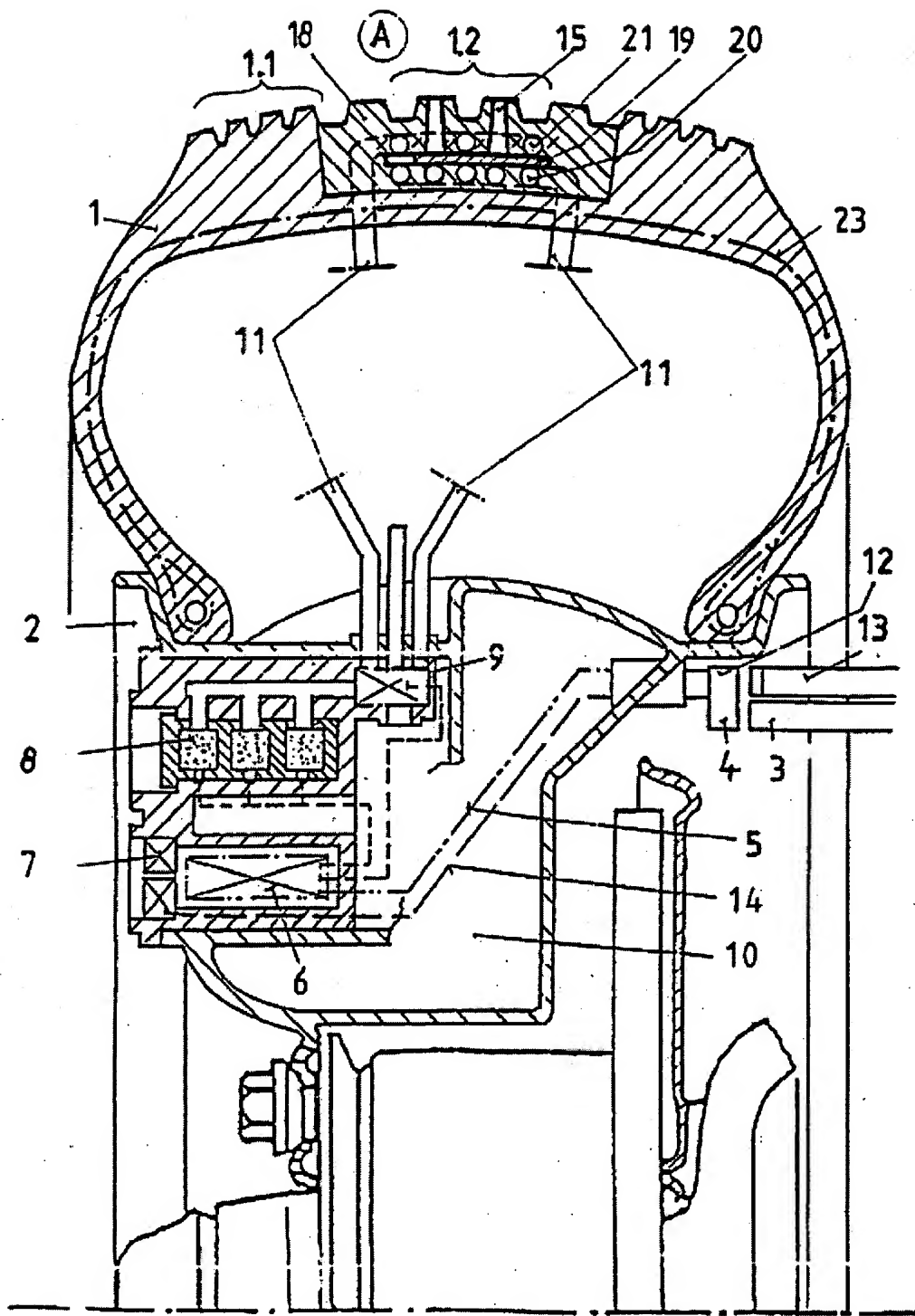


Figure 3: Antislip System for Motor Vehicle Wheels, illustrated in State 1: Spikes 15 fit flush with the tire tread.

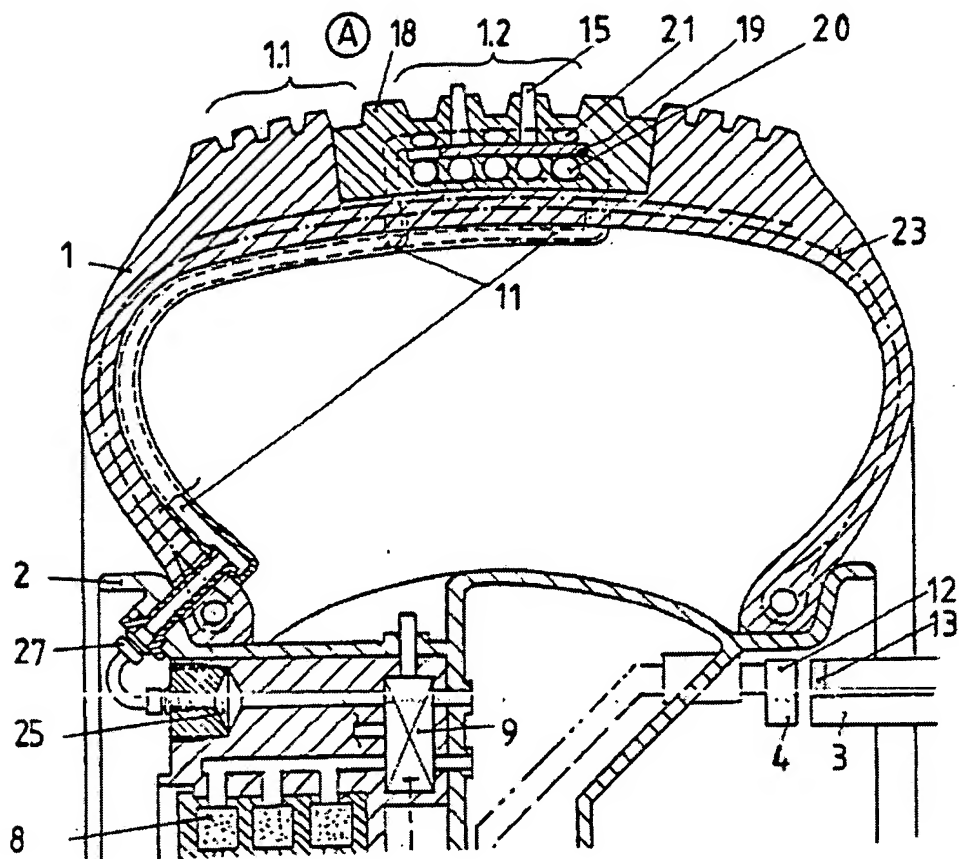


Figure 4. Antislip System for Motor Vehicle Wheels, illustrated in State 2: For icy road conditions, with Spikes 15 extended.

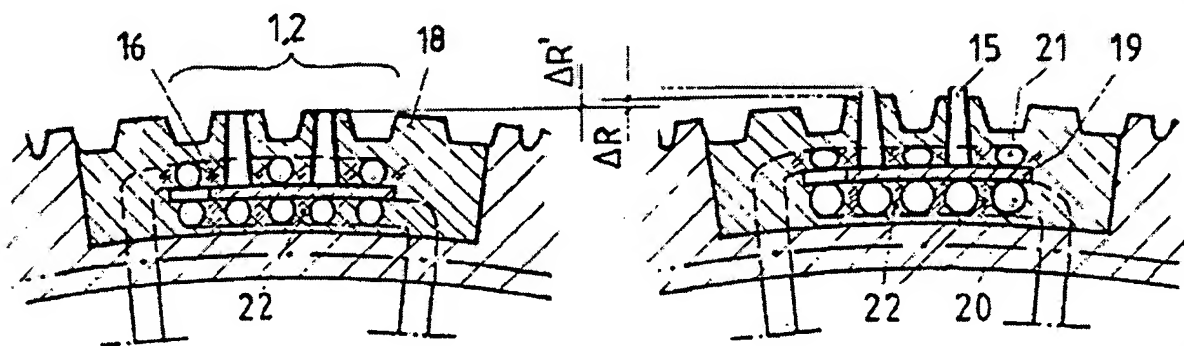


Figure 5
Detail A: Illustrated in 2 states. State 1: For normal road conditions. State 2: For icy road conditions.

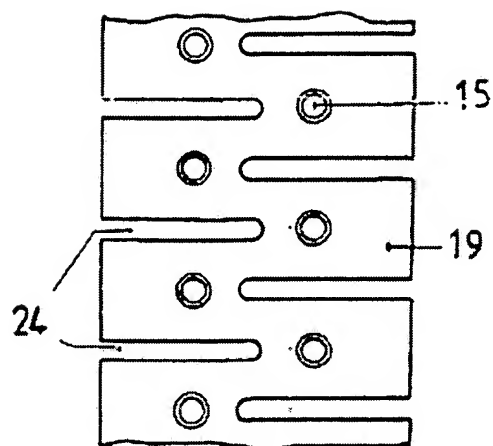


Figure 6

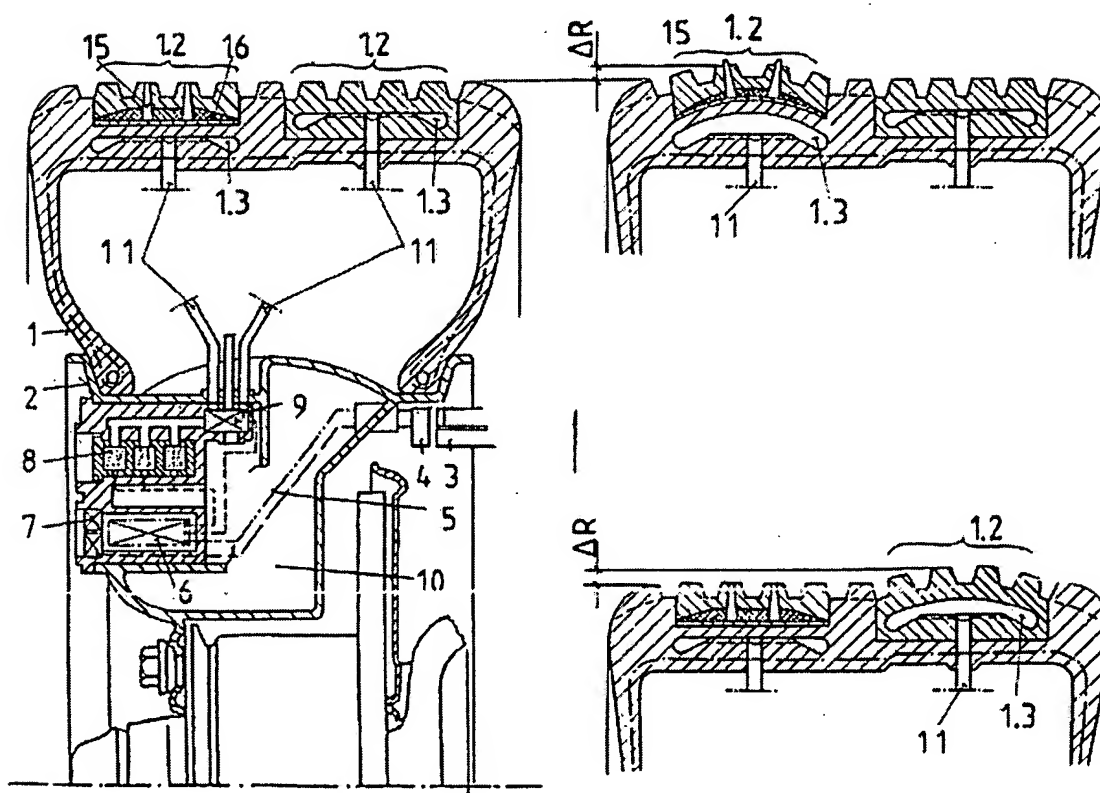


Figure 7. Vehicle Wheel with 3-chamber, All-weather Tires—illustrated in 3 states.

State 1: For normal road conditions

State 2: For icy road conditions

State 3: For wet road conditions

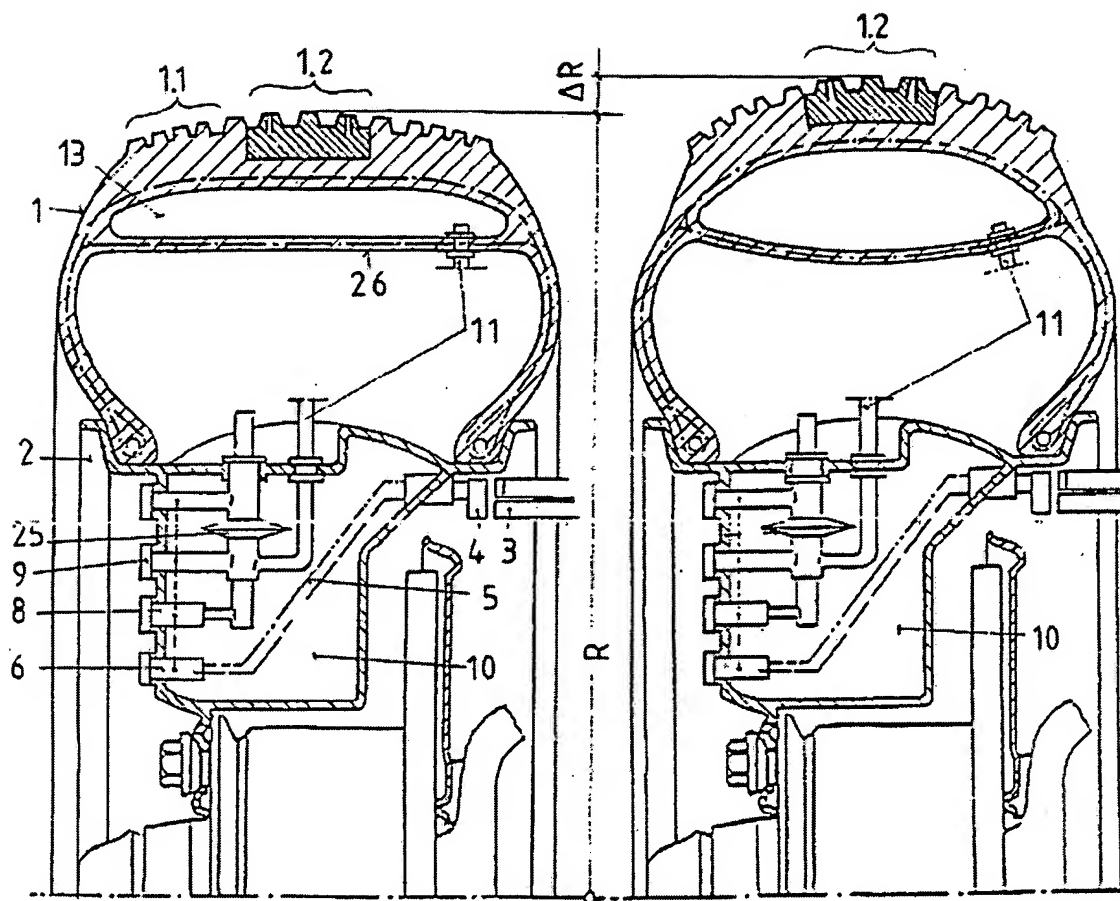


Figure 8. Vehicle Wheel with 2-chamber, All-weather Tires—illustrated in 2 states.

State 1: For normal road conditions

State 2: For icy road conditions

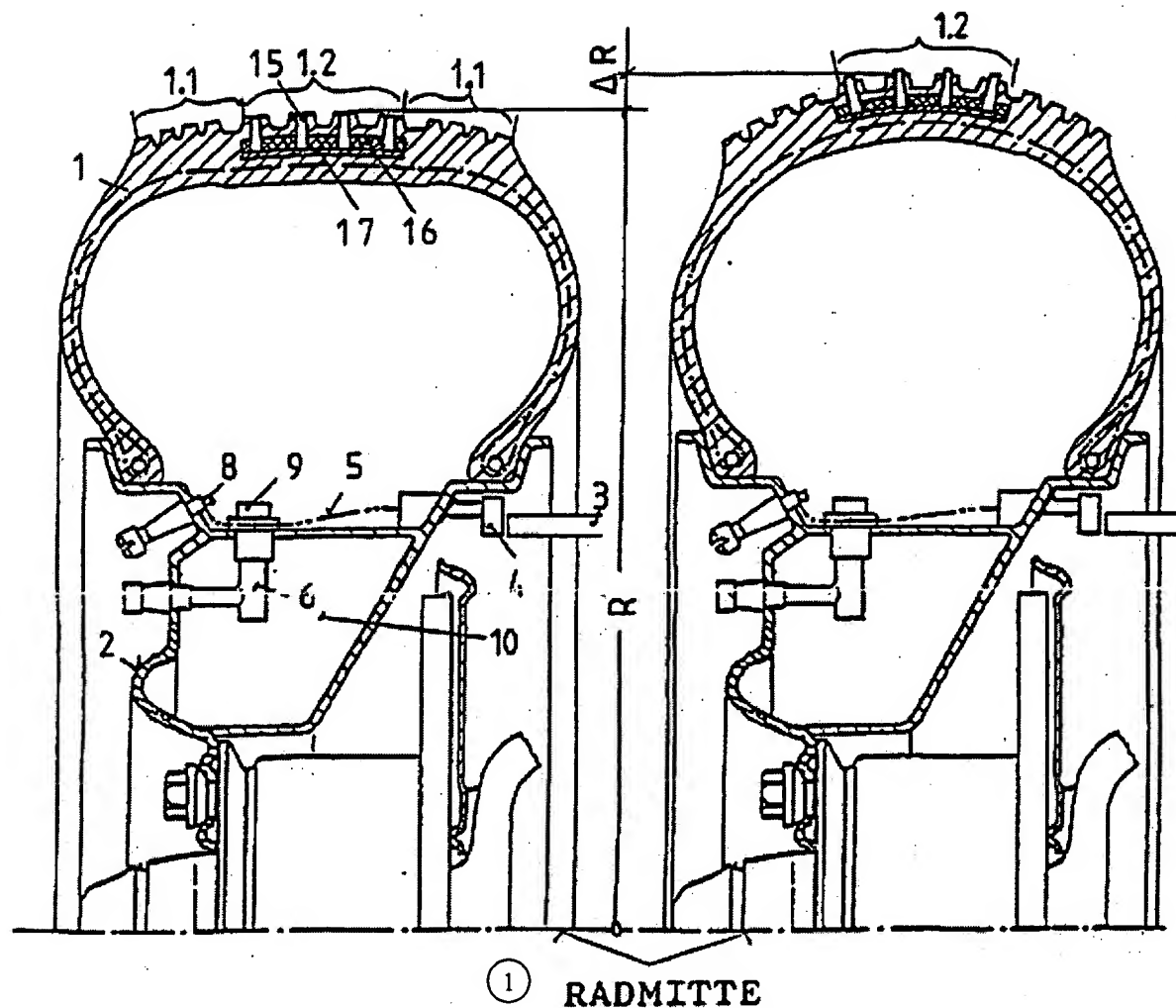


Figure 9. Antislip System for Motor Vehicle Wheels, illustrated in 2 States
 State 1: For normal road conditions. State 2: For icy road conditions

Key: 1 Middle of wheel

INTERNATIONAL SEARCH REPORT

International Application No PCT/DE 90/00448

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. ⁵ B60C11/16		
II. FIELDS SEARCHED		
Minimum Documentation Searched *		
Classification System	Classification Symbols	
Int.Cl. ⁵	B60C	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched *		
III. DOCUMENTS CONSIDERED TO BE RELEVANT *		
Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages **	Relevant to Claim No. **
Y	DE, A, 2131918 (W. BRUCKERT) 11 January 1973 see page 2, paragraph 2 - page 3, paragraph 1; figures 1, 2, 8 see page 7, paragraph 2 - page 8, paragraph 1 ---	1, 2, 6, 20
Y	US, A, 3942572 (A.L. CRANDALL) 09 March 1976 see the whole document ---	1, 2, 6, 20
X	PATENT ABSTRACTS OF JAPAN Vol. 11, No. 86 (M-572) (2533) 17 March 1987, & JP-A-61 241204 (YUTAKA SHIRAISHI) 27 October 1986, see the whole document ---	3, 4, 8
A	DE, A, 2202420 (R. RITTINGHAUS) 26 July 1973 see page 4, last paragraph - page 5, paragraph 1; figures ---	3, 4 ./...
<p>* Special categories of cited documents: **</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"A" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
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International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE		

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International Application No. PCT/DE 90/00448

14. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	DE, A, 3721500 (E.J. AGOT) 12 January 1989 see page 3, paragraph 2 - page 4, paragraph 3 ---	8, 9
A	DE, A, 2215843 (IVM INGENIEURLEISTUNGEN FÜR VERFAHRENSTECHNIK UND MASCHINENBAU) 11 October 1973 see claim 17 -----	6

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

DE 9000448
SA 37579

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
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11/09/9

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A-2131918	11-01-73	None	
US-A-3942572	09-03-76	None	
DE-A-2202420	26-07-73	None	
DE-A-3721500	12-01-89	None	
DE-A-2215843	11-10-73	None	

machine translation for DE 3721500

attachment to
paper no
110105**Retractable integrated tyre spike system (integrated spike system)**

Description OF DE3721500

The invention

"retractable - integrating - tire spades system" (EIR system) is based on a concept, in which a all- weathersuited tire system is intended. EIR system consists of a tire body, on whose formed extent a row pneumatically "spikes" (tire segments) are accommodated. By purposeful adjustment of these "spikes" the effect of a nail auxiliary wreath/ring system is obtained steplessly, without an assembly and/or a tire change must be made. There are therefore many intermediate positions infinitely (here: "profile configurations" mentioned), between completely brought in and completely driven out spikes result. These positions make possible that handling characteristics between summer and winter tires are simulated steplessly by only one tire system (EIR system) can along develop the general-purpose fitness of this EIR system.

The EIR system been based on the concept of an adjustable, inserted, permanent-integrated motor-car tire spades system, whose consist "spike" (adjustable tire segments) of the same or a more rigid material, as that of the main tire body, and are accordingly arbitrarily formed. The spikes can be arbitrary form and are attached along the tire extent in same distances. They are at will brought in or driven out, in order to adapt the EIR system steplessly to the momentarily dominant roadway situation. Adjusting the spikes by the EIR system takes place via regulated, pneumatic adjustment procedures, which are caused periodically, by a quasi-breathing procedure "spiked hermetic bellows" (pneumatic fold bellows). This happens periodically, if a given spike goes through the lower dead center (edge contact with roadway).

The manual execution of the EIR system possesses a switch and directly in the tire rim concerned is adjusted and/or switched on.

The semiautomatic execution of the EIR system is operated by remote control directly at the "cockpit", while the fully automatic is automatically steered directly by the on board computer over sensors.

With both automatic remarks the adjustment of the spikes is made by a regulating valve accommodated on the tire rim. This regulating valve is again electromagnetically operated. Altogether three remarks are to the drivers of all classes at the disposal. I.e., "manual" for cars of lower class, "half mechanism" for cars of middle class and "full mechanism" for cars of elevated class.

The pneumatic operating procedure

The building group of the EIR system consists of: a "tire pressure area" (tyre pressure cavity, designated: A), several "Hermetikspikesfaltenbalgen" (hermetic spiked bellows, designated: B), a "main inlet channel" (designated: 10), a "main discharge opening channel" (designated: 9), a "intake valve" (designated: 8), a "exhaust valve" (designated: 7) and a regulating valve (designated: to 12), see Abb. 1 to 6. The Hermetikspikes Faltenbalgen B is blown up pneumatically, if the regulating valve 12 is on the "driving out mode" and is closed the "discharge opening channel". The "excess air pressure" of the tire pressure area A in relation to the momentary "air negative pressure" of the "Hermetikspikesfaltenbalg concerned" B overcomes the "intake valve" B and thus takes place driving the spike out up to the pressure balance between the two pressure chambers.

Bringing the "Hermetikspikesfaltenbalgen" B in takes place, if the "regulating valve" 12 on "bringing in mode" is and is closed the "inlet channel". Each Hermetikspikesfaltenbalg, which is momentarily in the contact with the roadway, experiences a higher pressure. This pressure is based on the part by weight of the car, working as bearing force on the tire concerned. Compressed air is displaced into the tire pressure area inside, provided that the position of the regulating valve permits it! Thus regulated "bringing" of the spikes in takes place. This procedure repeats itself for each Hermetikspikesfaltenbalg during the turn of the Rades. The position of the "throttle unit" of the "regulating valve" determines the adjusting path (spike

depth) of the retracting and/or extending the "spikes" and the changed adhesion Reifens. Hierdurch concerned all demands, which one makes at summer and/or winter tires, by the same tires is thus fulfilled. The purchase of different summer and winter tires becomes corresponding redundantly. Auxiliary aggregates, like chains, nail auxiliary rings etc., become likewise dispensable, since the EIR system offers suitable profile configurations also for driving in the deep snow.

Manual circuit

The manual circuit of the EIR system is made by a "multi-use switch", which is attached at the tire rim concerned. The driver must know the suitable position of the switch. This it can take from the data of the manufacturer, in accordance with the momentary roadway condition. The attitude takes place manually with the standing vehicle. Since this execution is the simplest, it is also the cheapest version.

Semiautomatic regulation

The semiautomatic regulation is made by an electromagnetic regulating valve. This regulating valve is steered via electrical sliprings at the support of the brake both and supplied with river. Sometimes a telemetric control and/or an inductive supply for vehicles of the elevated class could be planned. Data inputs take place at the "cockpit", where also sometimes indicators are to be accommodated for support. During mechanism circuit the regulation is "dynamic", i.e. it is readjusted with the driving vehicle.

Fully automatic regulation

The fully automatic regulation is very similar to the semiautomatic regulation concerning supply and data input at the "cockpit". However the difference consists of the fact that the decisions are not made by the driver, but the on board computer steers everything automatically. But the computer gets the parameters electronically directly from two electronic sensors, which constantly scan the slip and/or a blocking of the wheels and which momentary data communicate to the computer. The on board computer determines from it the necessary corrections at the tire concerned, in order to compensate the slip and/or a blocking of a Rades. This system makes possible also that the "spikes" are in time driven out, if "aquaplaning" threatens. This system is to be integrated in the ABS system.

New shaping

It is recommendable to provide the EIR system with such shapings that one can retread, without substantial parts are damaged. Thus the life span is extended, in order to favour the amortization of the system.

Constructional concept

Abb. 1 and 2 represents the front as well as the side views of the EIR system. Abb. 3 and 4 represents the steps of brought in and/or driven out "spike modules" in a laengsansicht. Abb. 5 and 6 represents the same like 3 and 4 however in transverse opinion.

The EIR system consists of several inserted pneumatic-adjustable "spike modules". Each spike module consists of a rubber shaping 1, which impregnated 2 on a metal cap. This metal cap slides within the metal basin 3, whose internal part is coated with hard plastic 15. The hard plastic coating 15 makes a smooth sliding for the metal cap possible 2 in the metal basin 3 with adjusting a spike. The metal basins 3 impregnated among themselves 9 in the tire movement area and with steel wire belt in circumferential direction connected. Thus the tangential force is distributed evenly on a spike in the tire body. Exactly the same the metal basins 3 are intended in the transverse direction with steel reinforcements. Furthermore

the metal cap 2 and the metal basin 3 are among themselves over springy fold bellows (jump integrated hermetic bellows; 6) connect-connecting that Hermetik spike bellows pressure chamber 6 is connected by an intake valve 8 and an exhaust valve 7 with the tire pressure area A by the regulating valve 12. The valves 7 and 8 are on; Main discharge opening channel 11 and main inlet channel 10 are attached to the tire pressure area (tyre pressure cavity, A) over a stepless throttle and regulating valve 12. The manipulation of this valve 12 takes place either automatically or manually, depending upon execution (see automatic regulation).

The metal basin 3 is manufactured in two halves and brought together only when assembling. So that part of 2 remains permanently of out flies (due to the centrifugal energy) secured. The regulating valve and the other EIR system aggregates must be balanced, in order to make even rotation possible of the wheels. The amount of the "spike module" is arbitrary and with the development for each motor vehicle type is intended. With the manufacturing the parts must be so dimensioned that an inadvertent coincidence manipulation does not result from the centrifugal force influence. The development is further to point, whether part of 1 can be made nevertheless threaded, by simply replacing to ensure-ensuring those final construction of the EIR system can from this statement deviate, although the concept one adjustably -, integrated -, dynamically -, general-purposesuited tire system a component of this invention remains.

EIR system parameter and configuration pattern
EMI11.1

Component list of the EIR system 1 renewable spike shaping 2 metal cap 3 impregnated metal basin (from two halves one assembles) 4 main movement area of the tire 5 Spike-Profil-clammy of 6 feather-integrated hermetic bellows 7 exhaust valve 8 intake valve 9 impregnated steel reinforcement wires (all basins are among themselves connected) 10 main inlet channel 11 main discharge opening channel 12 multi-use regulating valve with adjustable throttle effect, (electromagnetically when automatic regulation) 13 tire rim, on that the parts: 10, 11 and 12 attached and balanced are 14 spike adjustment direction 15 hard plastic interior coating for metal basin 3 16 transverse stiffener (stabilizer) for spike modules of 17 rule switches for manual EIR system of 18 main tire bodies A tire pressure area (type pressure cavity) B Hermetikspikesfaltenbalg (spiked hermetic bellow)

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Retractable integrated tyre spike system (integrated spike system)

Claims OF DE3721500

1. My principal claim is based on the general-purpose fitness of the EIR system and thus on the fact that the spikes (tire segments) are steplessly retractable and/or extendable that of hard rubber consists the movement area of the spikes and is accordingly formed that the spikes are permanently integrated in the tire that the spike from a formed movement area, a feather integrate Hermetikfaltenbalg, a metal cap, a metal basin (in two halves) as well as from two valves exists.
2. My requirement been based on requirement 1 and is characterized by the fact that the manipulation of the adjustment mechanism of the EIR system of pneumatic kind is and effected incremental via periodic-quasi-breathing procedure between the tire pressure area and the Spikeshermetikfaltenbalgen. Dies takes place, because both areas are pneumatically isolated up to their connection over the regulating valve (12). Furthermore the regulating valve (12) with a throttle unit is integrated, whereby the function makes the stepless retracting and/or extending of the spikes for this unit possible.
3. My requirement been based on the requirements 1 and 2 and is characterized by the fact that the Spikeshermetikfaltbalgen is blown up in the normal condition. Thus the same pressure prevails both in the tire pressure area and in the individual Spikeshermetikfaltenbalgen. In this condition is the regulating valve on driving out mode, the main inlet channel is open, while the main discharge opening channel is opened closed be if the main discharge opening channel by the regulating valve, while the main inlet channel is closed, takes place a displacement of air from that spike, which is in this moment in contact with the roadway, in the tire pressure area. This procedure repeats itself for each spike, while the wheel turns. The opening of the throttle unit determines thereby the speed, with which adjusting takes place. If the regulating valve is to have been reversed to driving out mode, then air is displaced back into the spikes, in order to reach pressure balance of the normal condition. The displacement strength is equal to the normal force (bearing force), which affects the wheel concerned.
4. Mein requirement been based on the requirements 1 to 3 and is characterized by the fact that the spike movement area (1) on the metal cap (2) is appropriate that the metal cap (2) slides within the metal basin (3) freely that the metal basin (3) is coated with hard plastic inside that metal basins (3) are interconnected by steel wires in the circumferential direction that these metal basins (3) are stabilized by steel strips also in the transverse direction that the steel strips and/or the steel wires impregnated that the Hermetikfaltenbalgen is connected by a main discharge opening channel by means of delimitation valves with the tire pressure area by the regulating valve that the regulating valve is electromagnetically operated, except during the manual execution, where it is adjusted manually at the tire rim.
5. Mein requirement been based on the requirements 1 to 4 and is characterized by it that the form and arrangement of the spikes at the tire extent of arbitrary kind can be, thus independently of the kind, which is described in these revealing, however is hereby stressed imitations concerning the arrangement of the spikes.
6. My requirement been based on the requirements 1 to 5 and is characterized by the fact that a similar system, to whose emphasis on adjustable auxiliary chains or on adjustable tire treads or on adjustable nail auxiliary rings or on adjustable tire segments is based it are hereby stressed.
7. Mein requirement been based on requirements 1 to 6 and is by it marked that a similar system, whose means of actuation is based not pneumatically but electrically, electromagnetically, thermoelectric, thermochemically, mechanically, hydraulically or manually effected and otherwise on EIR system is hereby stressed.
8. My requirement been based on the requirements 1 to 7 and is characterized by the fact that a similar system, whose tire with emergency roll characteristics is integrated remains a component of this invention.
9. My requirement been based on requirements 1 to 8 and is by it marked that a similar system, whose profilrillen mechanically, semiautomatically or fully automatic, rotary, swivelling or shifting adjustable is

made is a component of this invention.

my requirement been based on the requirements 1 to 9 and is characterized by the fact that (more pumping) a tire remains even more ventilating by the principle of the EIR system or a similar system a component of this invention; as well as a tire, whose emergency wheel system (hose) is blown up by such a EIR system, remains a component of this invention.

11 My requirement been based on requirements 1 to 10 and is by it marked that a similar system, whose supply takes place by means of river, compressed air or hydraulics from outside of the Rades is hereby stressed.

12. My requirement been based on requirements 1 to 11 and is by it marked that a similar system, whose control or supply takes place by means of sliprings, or telemetrically or inductively from outside of as well as from within the Rades is a component of this invention.

13. Mein requirement been based on the requirements 1 to 12 and is characterized by the fact that another arrangement of the spikes, which is steered in the kind of the EIR system remains a component of this invention.

14. My requirement been based on the requirements 1 to 13 and is characterized by the fact that each automatic adjustment mechanism, whose manipulation takes two or three different pressure chambers up and on positive pressure in the normal condition and a pumping procedure at the edge contact between the roadway and a tire movement area (tire segment) is based, is hereby stressed.

15. My requirement been based on the requirements 1 to 14 and is characterized by the fact that each automatic or semiautomatic or manual or pneumatic or hydraulic or mechanical or electrical sliding protection adjustment or switching on system, that takes place directly at the tire or tire wheel while driving or with the manual system, if no assembly parts (e.g. chains, nail auxiliary rings etc..) are applicable, is thus hereby stressed a component of this invention and.

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